XX. *Elements of new Tables of the Motions of* Jupiter*'s Satellites: In a Letter to the Reverend* Charles Mason, *D. D.* Woodwardian *Professor in the University of* Cambridge, *and F. R. S. from Mr.* Richard Dunthorne.

SIR, Cambridge, March 3, 1761.

Read March 5, 1761.

THE public employment *, wherein I am at present, and for several years past have been, engaged, not permitting me to make new tables of the motions of Jupiter's satellites, according to the last corrections I had (from a comparison of more than eight hundred observations) made in the places and orbits of those planets, I am at last persuaded to communicate, by your means, to the Royal Society, the elements of those tables, hoping they will prove no unacceptable present to astronomers.

The tables are designed upon the plan of those of Mr. Pound for the first satellite, published in the Philosophical Transactions, N° 361. except that I have not deducted the greatest equations from the epochs, as is done by Mr. Pound.

The epochs of the conjunctions of the several satellites with Jupiter, fitted to the Julian year (before the alteration of the style in England), and to the meridian of the Royal Observatory at Greenwich, are as follows.

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* That of surveyor to the corporation of the great level of the fens.

Jul. years cur-rent.	Conj. 1ſt ſat. D.H.	′	″	Num. A.	Num. B.	Num. C.	Conj. 2d ſat. D.H.	′	″	Conj. 3d ſat. D.H.	′	″	Conj. 4th ſat. D.H.	′	″
1728	0 21	58	16	630	651	484	0 21	20	0	6 4	57	0	2 3	25	0
1748	0 3	7	18	316	962	175	3 2	32	24	3 18	7	54	1 16	37	41
1768	1 2	44	57	2	278	869	1 18	26	54	1 7	13	48	1 5	50	22

Number C is the period of 437 days (wherein the three innermoſt ſatellites return very nearly to the ſame ſituation in reſpect of one another, and of Jupiter's ſhadow), in milleſimals of a circle; and muſt be corrected by the equation of number B, under a contrary title.

The ſecond ſatellite has a ſynodical equation of 16′ or 17 in time (whoſe revolution is in this period), to be ſubtracted, if numb. C be leſs than 500; added, if greater. The firſt and third ſatellites have alſo ſmall ſynodical equations (returning in the ſame period), that of the firſt ſatellite being about 3′, of the third about 2′ in time; both to be added, if numb. C be leſs than 500; ſubtracted, if greater.

The orbit of the third ſatellite is manifeſtly excentric, as well as that of the fourth. Its apojovium in 1728 was about 10° of ♈, and moves forward 35° in 20 years: its greateſt equation is about 15′ in the ſatellite's orbit, or 7′ in time.

The apojovium of the fourth ſatellite in 1728, was in 12° 30′ of ♓, and moves forward about 12° in 20 years: its greateſt equation is 53′ in the ſatellite's orbit, or 59′ in time.

I found no reaſon to make any alteration in the ſemi-durations of the eclipſes of the firſt ſatellite from Mr. Pound's tables.

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The greatest semi-durations of the eclipses of the second, third, and fourth satellites in the nodes, are $1^h\ 27'$, $1^h\ 47'$, and $2^h\ 24'$ *, respectively.

The nodes of the second satellite seem to be at rest in about 50° of ♒ and ♌; but the inclination of its orbit varies from 2° 50′ to 3° 52′: it was least in 1668, greatest in 1715, and seems to have been at its greatest and least once in the intermediate years. I suppose it at the least in 1730.

The nodes of the third satellite in 1727, were in $16\frac{1}{2}$° of ♒ and ♌, and move forward about $2\frac{1}{2}$° in 20 years: the inclination of its orbit in 1695 was 3°, and has been increasing ever since: it seems as if it would get to its maximum about 1765, and would then be about 3° 24′.

The nodes of the fourth satellite in 1730 were in $13\frac{1}{2}$° of ♒ and ♌, and move forward 2° in 12 years: the inclination of its orbit is about 2° 40′, and does not seem to vary above one or two minutes either way.

From these elements, it will be easy for any person, moderately skilled in such matters, to construct tables of the motions of the satellites in the method of Mr. Pound, which may be seen in the latter part of Halley's tables.

I am, SIR,

Your humble servant,

Richard Dunthorne.

* The semi-durations of the eclipses of the fourth satellite will be about 2′ more at the ascending, and 2′ less at the descending node, on account of the excentricity of its orbit.